CLAIMS

1. A method of inducing a layer of compressive residual stress in the surface of a part comprising the steps of:

selecting a region of the part to be treated;

selecting the magnitude of compression and the residual stress distribution to be induced in the surface of the selected region;

exerting pressure against the surface of the selected region, the pressure being applied in a selected pattern along the surface to form zones of deformation having a deep layer of compressive stress; and

varying the pressure being exerted against the surface to produce the desired residual stress distribution and magnitude of compression within the surface.

2. The method of Claim 1 whereby the pressure being exerted against the surface of the part is performed by a burnishing operation.

3. The method of Claim 1 wherein said pressure being exerted on the surface of the part induces a deep layer of compression within the surface having associated cold working of less than about 5.0 percent.

4. The method of Claim 1 wherein said pressure being exerted on the surface of the part induces a deep layer of compression within the surface having associated cold working of less than about 3.5 percent.

5. The method of Claim 1 further wherein the step of selecting the magnitude of compression includes the step of programming a control unit to automatically adjust the magnitude of compression being induced within the surface of the part.

6. The method of Claim 1 wherein the selected pattern along the surface varies the spacing between the zones of deformation.

7. The method of Claim 1 wherein the step of exerting pressure against the surface of the selected region includes the step of programming a control unit to control the application of said pressure.

8. The method of Claim 1 ~~wherein the step of~~ varying the pressure being exerted against the surface ~~includes the step of~~ inducing a more shallow layer of compressive stress within the surface of the part.

9. The method of Claim 1 further comprising the step of removing a layer of material along the surface being in low compression or tension.

10. The method of Claim 1 wherein the part is selected from the group consisting of automotive parts, aircraft parts, marine parts, engine parts, motor parts, machine parts, drilling parts, construction parts, pump parts, and parts for use in turbo-machinery.

Sub A2 B2

11. A method of inducing a layer of compressive stress in the surface of a part comprising the steps of:

selecting a region of the part to be treated;

selecting the magnitude of compression and the residual stress distribution to be induced in the surface of the selected region;

programming a control unit to pass a burnishing member of a burnishing apparatus over the selected region in the selected pattern to produce a zone of deformation having a deep layer of compression within the surface; and

programming the control unit to increase, decrease or maintain the pressure being exerted against the surface at selected points along the selected pattern to obtain the desired residual stress distribution and magnitude of compression within the surface.

12. The method of Claim 11 wherein said pressure being exerted on the surface of the part induces a deep layer of compression within the surface having associated cold working of less than about 5.0 percent.

13. The method of Claim 11 wherein said pressure being exerted on the surface of the part induces a deep layer of compression within the surface having associated cold working of less than about 3.5 percent.

14. The method of Claim 11 wherein the burnishing apparatus comprises means for automatically adjusting the pressure being exerted against the surface of the selected region to increase on the high points and decreases on the low points encountered by the burnishing member along the surface of the part.

Sub B3

15. A method of inducing a layer of compressive stress in the surface of a part comprising the steps of:

selecting a region of the part to be treated;

selecting the magnitude of compression and the residual stress distribution to be induced in the surface of the selected region;

programming a control unit of a burnishing apparatus to perform a burnishing operation, the burnishing operation being performed along the selected region in a selected pattern to produce a zone of deformation having a deep layer of compression within the surface having associated cold working of less than about 5.0 percent; and

performing a second operation to induce a more shallow layer of compressive stress within the surface of the part to produce the desired stress distribution;

whereby said burnishing apparatus further comprising means for automatically adjusting the pressure being exerted against the surface of the selected region that increases on the high points and decreases on the low points that are encountered along the surface of the part during the burnishing operation.

16. A burnishing apparatus for inducing a compressive stress in the surface of a part comprising:

a burnishing member;

a socket having a inner chamber and a seat for receiving said burnishing member;

means for applying a force against said burnishing member for exerting pressure against the surface of the part; and

means for providing a constant volume of fluid to said inner chamber;

wherein said socket provides a clearance between said seat and said burnishing member for permitting the fluid to pass.

17. The burnishing apparatus of Claim 16 further comprising:

a pressure sensor for monitoring the fluid pressure; and

means for adjusting the force being applied against the burnishing member and the corresponding pressure being exerted by said burnishing member against the surface in response to the fluid pressure.

18. The burnishing apparatus of Claim 16 further comprising:

a programmable control means configured to continuously track the position of the burnishing member and for automatically adjusting the force being applied against the burnishing member and the corresponding pressure being applied against the surface by said burnishing member.

19. The burnishing apparatus of Claim 16 further comprising:

a programmable control means configured to direct the motion of said burnishing member in a selected pattern across the surface of a part.

20. A blade for use in turbo-machinery comprising:

a generally rectangular platform;

an elongated airfoil having a leading edge and a trailing edge, the airfoil being attached to and extending radially outwardly from said platform; and

a root attached to said platform and extending radially inwardly from said platform;

wherein said blade having been treated by the method of Claim 1.

21. The blade of Claim 20 further comprising the step of inducing a more shallow layer of compressive stress within the surface of the selected region.

22. The blade of Claim 20 further comprising the step of removing a layer of material along the surface being in low compression or tension.

23. A rotor disk for use in turbo-machinery comprising means for supporting a plurality of blades, wherein said rotor disk having been treated by the method of Claim 1.

24. The rotor disk of Claim 23 further comprising the step of inducing a more shallow layer of compressive stress within the surface of the selected region.

25. The rotor disk of Claim 23 further comprising the step of removing a layer of material along the surface being in low compression or tension.